

Mammalia, Didelphimorphia, Didelphidae, *Glironia venusta* Thomas, 1912 and *Chironectes minimus* (Zimmermann, 1780): Distribution extension for eastern Amazonia

Natália Ardente^{1*}, Donald Gettinger², Raul Fonseca³, Helena de Godoy Bergallo¹ and Fernanda Martins-Hatano⁴

¹ Universidade do Estado do Rio de Janeiro, Instituto de Biologia Roberto Alcântara Gomes, Departamento de Ecologia, Laboratório de Ecologia de Mamíferos. Rua São Francisco Xavier 524. CEP 20559-900. Rio de Janeiro, RJ, Brazil.

² University of Nebraska-Lincoln, Harold W. Manter Laboratory of Parasitology. W529 Nebraska Hall. 68588-0514. Lincoln, Nebraska, U.S.A.

³ Universidade do Estado do Rio de Janeiro, Instituto de Biologia Roberto Alcântara Gomes, Departamento de Zoologia, Laboratório de Mastozoologia. Rua São Francisco Xavier 524. CEP 20559-900. Rio de Janeiro, RJ, Brazil.

⁴ Universidade Federal Rural da Amazônia, Instituto de Saúde e Produção Animal, Departamento de Biologia Animal. Avenida Presidente Tancredo Neves, 2501. CEP 66.077-901. Belém, PA, Brazil.

* Corresponding author. E-mail: natyardente@yahoo.com.br

ABSTRACT: We report a new record for the bushy-tailed opossum *Glironia venusta* Thomas, 1912 and the water opossum *Chironectes minimus* (Zimmermann, 1780) in the Floresta Nacional de Carajás, municipality of Parauapebas, state of Pará, Brazil ($06^{\circ}03'00''$ S, $50^{\circ}15'00''$ W). This study represents the second record of *Glironia venusta*, but the first voucher specimen for eastern Brazilian Amazon. For *Chironectes minimus*, this record extends the range of the species 558 km southeastwards from the closest known locality in Pará.

During an inventory of small mammal species within the Floresta Nacional de Carajás in the Brazilian state of Pará, two species of poorly known and rarely surveyed marsupials were collected as voucher specimens: *Glironia venusta* Thomas, 1912 and *Chironectes minimus* (Zimmermann, 1780). Both species present diagnostic characters that are easy to identify (see Gardner 2008; Voss and Jansa 2009), being highly adapted to specific habitats.

The genus *Glironia* is monotypic, the single living species, *Glironia venusta* Thomas, 1912, is a distinctive medium-sized and bushy-tailed opossum (Marshall 1978a; Wilson and Reeder 2005). Little is known about the real geographic distribution of this rare and vulnerable species (Bernarde and Rocha 2003; Díaz and Willig 2004), known from only 20 localities in South America, and restricted to the Amazon Forest in Bolivia, Ecuador, Peru, Brazil and Colombia (Marshall 1978a; Gardner 2008). In Brazil, *G. venusta* has been recorded from the states of Acre (Bernarde and Machado 2008), Amazonas (Nogueira *et al.* 1999; Calzada *et al.* 2008), Pará (Da Silva and Langguth 1989; Rossi *et al.* 2010), Rondônia (Bernarde and Rocha 2003; Santos-Filho *et al.* 2007) and Mato Grosso (Santos-Filho *et al.* 2007).

The voucher specimen (field number DG 67), an adult male weighting 119 g, was captured in the Floresta Nacional de Carajás ($06^{\circ}03'00''$ S, $50^{\circ}15'00''$ W), municipality of Parauapebas, state of Pará, Brazil. The specimen was captured in August, 2010, during the dry season, in a Sherman trap placed in the lower canopy of the rain forest (8.6 m high). The specimen was prepared as a skin and full skeleton, with associated tissue samples, and is deposited in the Museu Nacional, Universidade Federal do Rio de Janeiro (MN), with the reference number

MN 75062 (Figures 1 and 2). This is the second record of *G. venusta* from the state of Pará and the eighth for Brazil (Figure 3). Rossi *et al.* (2010) first reported this species in the Floresta Nacional Tapirapé-Aquiri, municipality of Marabá, Brazil, by a photograph.

External measurements: Body length, 178 mm; Tail length, 214 mm; Hind foot length (including claw), 35 mm; Ear length from notch, 27 mm. Cranial measurements,



FIGURE 1. *Glironia venusta* (male, MN 75062) trapped in eastern Amazonia, Floresta Nacional de Carajás, Pará, Brazil.

following Voss *et al.* (2001) are: Nasal Breadth (NB), 5.85 mm; Least Interorbital Breadth (LIB), 6.74 mm; Least Postorbital Breadth (LPB), 8.46 mm; Zygomatic Breadth (ZB), 24.02 mm; Palatal Length (PL), 23.84 mm; Condyllobasal Length (CBL), 39.18 mm; Palatal Breadth (PB), 11.21 mm; Maxillary Toothrow (MTR), 16.65 mm; Molar Length (LM), 7.77 mm.

The monotypic genus *Chironectes* is represented by *Chironectes minimus* (Zimmermann, 1780), a large and



FIGURE 2. *Glironia venusta* (male, MN 75062), dorsal, ventral, and lateral views of skull; Floresta Nacional de Carajás, Pará, Brazil.

semiaquatic opossum (Marshall 1978b; Nowak 1991). According to Brown (2004) and Gardner (2008), *C. minimus* can be found in tropical and subtropical habitats of Central and South America, in Panama, northward into southern Mexico, in Colombia, Ecuador, Peru, Bolivia, Paraguay, northeastern Argentina, in Venezuela, Guyana, French Guiana, southern to Brazil. In the Brazilian Amazon, it is known from only four localities in the state of Pará: Barcarena (Pine 1973) and according to Brown (2004): Cametá; “Peixe-boi” and Ilha das Onças, in Belém and Utinga, and was recently recorded for three localities in the northwestern of Maranhão state (Oliveira *et al.* 2007).

Despite its wide distribution, *C. minimus* is still a poorly understood species regarding its biogeographic-ecological features along the geographical distribution. According to Galliez *et al.* (2009) this species does not show seasonality in its reproduction, as commonly observed in other marsupial species. *Chironectes minimus* has some morphological adaptations to semi-aquatic life, such as an interdigital membrane in the hind feet, a developed pouch and a laterally compressed tail (Marshall 1978b; Monteiro-Filho *et al.* 2006). Individuals of water opossum are rarely captured (Bressiani and Graipel 2008) and few specimens can be found in scientific collections (Monteiro-Filho *et al.* 2006). However, Emmons (1990) and Monteiro-Filho *et al.* (2006) considered it a common species. This information is in accordance with the methods frequently used to record *C. minimus*, such as visual reports (Bergallo 1994; Voss *et al.* 2001), firearms (Mondolfi and Padilla 1958; Voss *et al.* 2001) and hand-captures (Mares *et al.* 1989; González and Fregueiro 1998; Voss *et al.* 2001; Graipel *et al.* 2006). This difficulty is related to the fact that *C. minimus* is not attracted to the bait in live traps (Voss and Emmons 1996; Monteiro-Filho and Graipel 2006; Monteiro-Filho *et al.* 2006) and inhabit rivers and brooks, where it is difficult

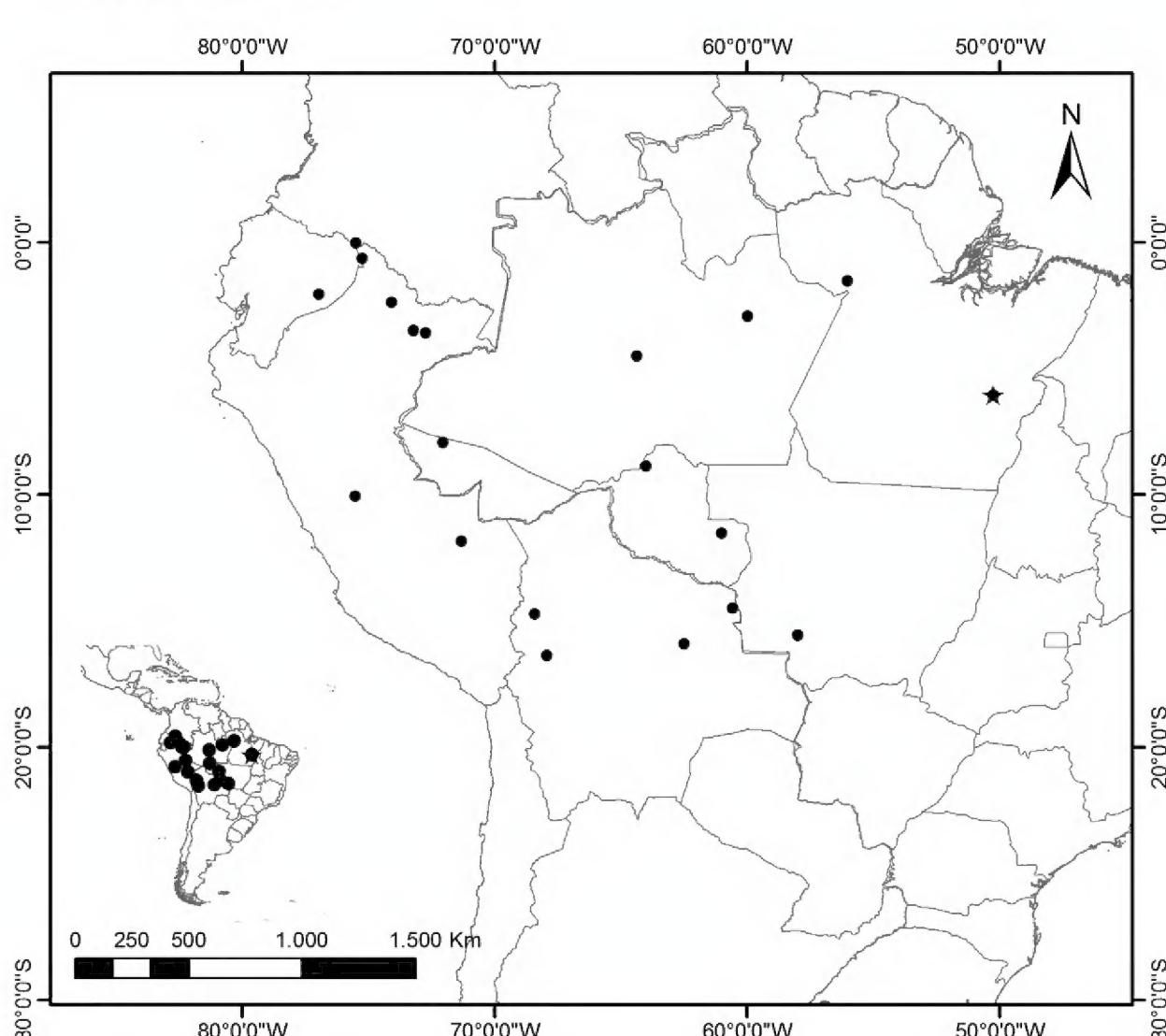


FIGURE 3. Geographic distribution of *Glironia venusta*. Black circles represent data from literature (Da Silva and Langguth 1989; Nogueira *et al.* 1999; Bernarde and Rocha 2003; Díaz and Willig 2004; Santos-Filho *et al.* 2007; Calzada *et al.* 2008; Bernarde and Machado 2008; Gardner 2008; Rossi *et al.* 2010), and the star represents the new record in Floresta Nacional de Carajás, State of Pará, Brazil.

to set live traps.

There are few records of this species, especially in areas outside the shores of Brazil. The specimen of *C. minimus* surveyed, an adult male, was not trapped or collected manually, but was found dead in a road inside the Floresta Nacional de Carajás, municipality of Parauapebas, Pará, Brazil. It was prepared as a skeleton and deposited at the Museu Nacional, Universidade Federal do Rio de Janeiro (MN), with the reference number MN 78340. However, no measurements were undertaken due to the poor condition of the specimen (Figure 4). The specimen agrees with the description of *C. minimus* (Zimmermann, 1780), with dorsal color pattern silvery gray, overlaid with dark brown to black markings that consist of a narrow mid-dorsal stripe from the crown to the base of the tail, interconnecting four broad blackish patches located, each one, over shoulders, in the center of back, hips, and lower rump (Figure 4). The shoulder and rump patches extend laterally over the legs. The venter is bright white, sharply contrasting with the gray color of the sides. The muzzle, crown of the head, and a band extending through the eye to below the ear, are blackish-brown. The tail is either all black or black for about 4/5 of its length and yellowish-white terminally (Marshal 1978b; Nowak 1991). This species has a streamlined body shape, large webbed hind feet (Figure 5), dense and non wettable fur. Water opossums are unique among neotropical marsupials in their opposable 6th "finger" in the front feet, derived from a wrist bone, and also in that both sexes have a well-developed waterproof marsupium (Marshal 1978b; Nowak 1991).

The present record extends the geographic distribution of *C. minimus* about 558 km southward from the closest known locality in the state of Pará (Figure 6). This record is more inland the Brazilian Amazon, the remaining records are on the coast or on the edge of fragments in the extreme southeast of the Brazilian Amazon Forest. This record is

important because the Floresta Nacional de Carajás is the largest remaining forest fragment in southeastern Pará in good conservation condition and the area is set within a complex of protected areas. Such information can be very important for future work with this species.



FIGURE 4. Dorsal view of skin of *Chironectes minimus* (male, MN 78340) from Floresta Nacional de Carajás, State of Pará, Brazil.



FIGURE 5. The large webbed hind feet of *Chironectes minimus* (male, MN 78340) from Floresta Nacional de Carajás, State of Pará, Brazil.

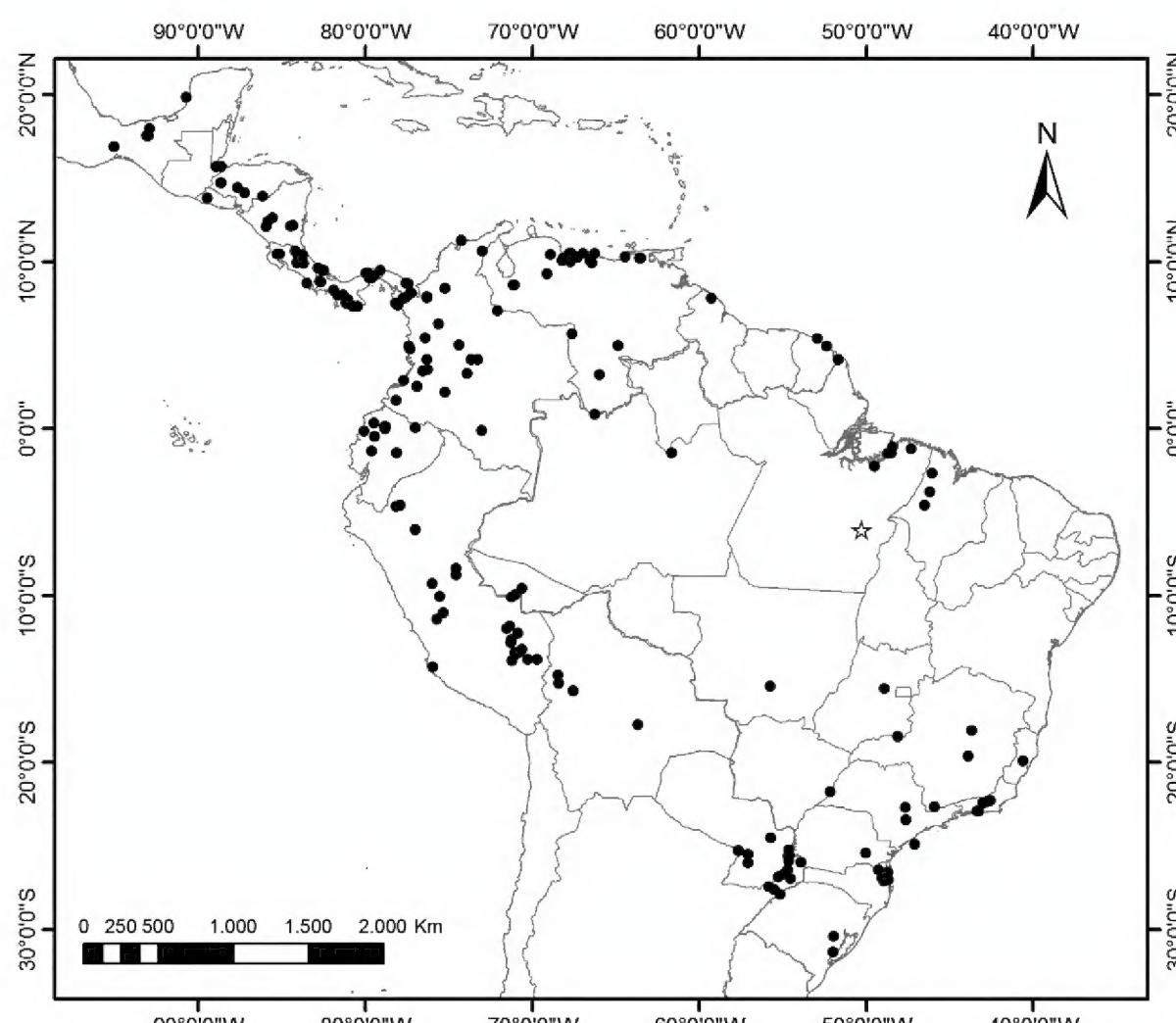


FIGURE 6. Geographic distribution of *Chironectes minimus*. Black circles represent data from literature (Brown 2004; Oliveira et al. 2007; Gardner 2008), and the star represents the new record from Floresta Nacional de Carajás, in the State of Pará, Brazil.

ACKNOWLEDGMENTS: We thank the Instituto Chico Mendes da Conservação da Biodiversidade (ICMBio) (License: IBAMA 009-B/2009 MAB/FAUNA) for permission to collect mammal specimens in the Floresta Nacional Serra dos Carajás. This study was funded by Vale (previously Cia. Vale do Rio Doce), and coordinated by Fernanda Martins-Hatano from Universidade Federal Rural da Amazônia (UFRA). During the study, Natália Carneiro Ardente and Donald Gettinger received a grant from Vale-UFRA (process 02018.001735/2006-91). Helena G. Bergallo thanks FAPERJ (E-26/103.016/2011), CNPq (307715/2009-4) and Prociência/UERJ for the researcher grants.

LITERATURE CITED

Bergallo, H.G. 1994. Ecology of a small mammal community in an Atlantic area in southeastern Brazil. *Studies on Neotropical Fauna and Environment* 29: 197-217.

Bernarde, P.S. and R.A. Machado. 2008. Mammalia, Didelphimorphia, Didelphidae, *Glironia venusta* Thomas, 1912: distribution extension to the state of Acre, Brazil. *Check List* 4(2): 151.

Bernarde, P.S. and V.J. Rocha. 2003. New record of *Glironia venusta* (Bushy-tailed opossum) (Mammalia, Glironiidae) for the State of Rondônia - Brazil. *Biociências* 11(2): 183-184.

Bressiani, V.B. and M.E. Graipel. 2008. Comparação de métodos para captura da cuíca-d'água, *Chironectes minimus* (Zimmerman, 1780) (Mammalia, Didelphidae) no sul do Brasil. *Mastozoologia Neotropical* 15(1): 33-39.

Brown, B.E. 2004. *Atlas of New World Marsupials*. Chicago: Fieldiana Zoology (New Series) 102: 308 p.

Calzada, J., M. Delibes, C. Keller, F. Palomares and W. Magnusson. 2008. First record of the Bushy-tailed opossum, *Glironia venusta*, Thomas, 1912, (Didelphimorphia) from Manaus, Amazonas, Brazil. *Acta Amazonica* 38(4): 807-810.

Da Silva, M.N.F. and A. Langguth. 1989. A new record of *Glironia venusta* from the lower Amazon, Brazil. *Journal of Mammalogy* 70: 873-875.

Díaz, M.M. and M.R. Willig. 2004. Nuevos registros de *Glironia venusta* y *Didelphis albiventris* (Didelphimorphia) para Perú. *Mastozoología Neotropical* 11(2): 185-192.

Emmons, L.H. 1990. *Neotropical rainforest mammals: A field guide*. Chicago: The University of Chicago Press. 281 p.

Galliez, M., M.S. Leite, T.L. Queiroz, and F.A.S. Fernandez. 2009. Ecology of the water opossum *Chironectes minimus* in Atlantic Forest Streams of Southeastern Brazil. *Journal of Mammalogy* 90(1): 93-103.

Gardner, A.L. 2008. *Mammals of South America, Volume 1: Marsupials, Xenarthrans, Shrews, and Bats*. Chicago: The University of Chicago Press. 669 p.

González, E.M. and G. Fregueiro. 1998. Primer registro de *Chironectes minimus* para Uruguay (Mammalia, Didelphidae). *Comunicaciones Zoológicas del Museo de Historia Natural de Montevideo* 12: 1-8.

Graipel, M.E., J.J. Cherem, E.L.A. Monteiro-Filho and L. Glock. 2006. Dinâmica populacional de marsupiais e roedores no Parque Municipal da Lagoa do Peri, Ilha de Santa Satarina, sul do Brasil. *Mastozoologia Neotropical* 13(1): 31-49.

Mares, M.A., J.K. Braun and D. Gettinger. 1989. Observations on the distribution and ecology of the mammals of the cerrado grasslands of central Brazil. *Annals of Carnegie Museum* 58: 1-58.

Marshall, L.G. 1978a. *Glironia venusta*. *Mammalian Species* 107: 1-3.

Marshall, L.G. 1978b. *Chironectes minimus*. *Mammalian Species* 109: 1-6.

Mondolfi, E. and G.M. Padilla. 1958. Contribución al conocimiento del "perrito de agua" (*Chironectes minimus* Zimmerman). *Memoria de la Fundación La Salle de Ciencias Naturales* 17: 141-155.

Monteiro-Filho, E.L.A., M.E. Graipel and N.C. Cáceres. 2006. História Natural da Cuíca-d'água *Chironectes minimus* e da cuíca-marrom *Lutreolina crassicaudata*; p. 287-295 In Cáceres, N.C. and E.L.A. Monteiro-Filho (ed.). *Marsupiais do Brasil: Biologia, Ecologia e Evolução*. Campo Grande, MS: Editora da Universidade Federal do Mato Grosso do Sul.

Monteiro-Filho, E.L.A and M.E. Graipel. 2006. Captura e Marcação; p. 17-27 In Cáceres, N.C. and E.L.A. Monteiro-Filho (ed.) *Marsupiais do Brasil: Biologia, Ecologia e Evolução*. Campo Grande, MS: Editora da Universidade Federal do Mato Grosso do Sul.

Nogueira, M.R., M.N.F. da Silva, G.G.O. Câmara. 1999. Morphology of the male genital system of the bushytailed opossum *Glironia venusta* Thomas, 1912 (Didelphimorphia, Didelphidae). *Mammalia* 63:231-36.

Nowak, R.M. 1991. *Walker's mammals of the world* (5th edition). Baltimore: Johns Hopkins University Press. 951 p.

Oliveira, T.G., R.G. Gerude and J.S. Silva Júnior. 2007. Unexpected mammalian records in the state of Maranhão. *Boletim do Museu Paraense Emílio Goeldi, Ciências Naturais* 2 (2): 23-32.

Pine, R.H. 1973. Mammals (exclusive of bats) of Belém, Pará, Brazil. *Acta Amazônica* 3: 47-79.

Rossi, R.V., C.L. Miranda, T.S.S. Júnior and T.B.F. Semedo. 2010. New records and geographic distribution of the rare *Glironia venusta* (Didelphimorphia, Didelphidae). *Mammalia* (74): 445-447.

Santos-Filho, M., M.N.F. Da Silva, B.A. Costa, C.G. Bantel, C.L.G. Vieira, D.J. Silva and A.M.R. Franco. 2007. New records of *Glironia venusta*, Thomas, 1912 (Mammalia, Didelphidae), from the Amazon and Paraguay basins, Brazil. *Mastozoología Neotropical* 14(1): 103-105.

Thomas, O. 1912. A new genus of opossums and a new tucotuco. *Ann. Mag. Nat. Hist.*, ser. 8, 9:239-41.

Voss, R.S. and L.H. Emmons. 1996. Mammalian diversity in neotropical lowland rainforests: a preliminary assessment. *Bulletin of the American Museum of Natural History* 230: 1-115.

Voss, R.S. and S.A. Jansa. 2009. Phylogenetic relationships and classification of didelphid marsupials, an extant radiation of New World metatherian mammals. *Bulletin of the American Museum of Natural History* 322: 1-177.

Voss, R.S., D.P. Lunde and N.B. Simmons. 2001. The mammals of Paracou, French Guiana: a neotropical lowland rainforest fauna: Nonvolant Species. *Bulletin of the American Museum of Natural History* 263(2): 1-236.

Wilson, D.E. and D.M. Reeder. 2005. *Mammal Species of the World: a Taxonomic and Geographic Reference*. Baltimore: Johns Hopkins University Press. 1945 p.

Zimmermann, E. A. W. 1780. *Geographische Geschichte der Menschen, und der algemein verbreiteten vierfüßigen Thiere*. Zweiter Band. Leipzig:Wenganschen Buchhandlung, 2:6.

RECEIVED: June 2012

ACCEPTED: September 2013

PUBLISHED ONLINE: October 2013

EDITORIAL RESPONSIBILITY: Ana Paula Carmignotto